KAON FLOW IN AU+AU COLLISIONS AT 1.23AGEV MEASURED WITH HADES

LUKÁŠ CHLAD[1,2] FOR THE HADES COLLABORATION
QUARK MATTER 2022 – POSTER SESSION 2 T14_1

[1] Nuclear Physics Institute of the CAS, Řež
[2] Faculty of Nuclear Sciences and Physical Engineering, CTU in Prague

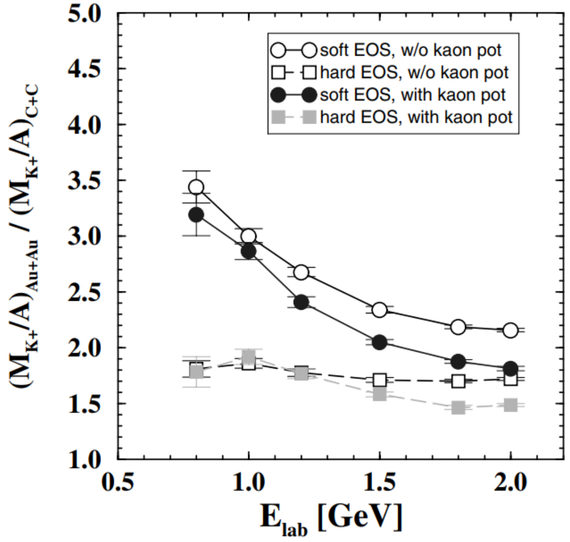
Work supported by:
MEYS CZ - LM2015049 and LM2018112 grant
FAIR-CZ-OP grant CZ.02.1.01/0.0/0.0/16_013/0001677
GACR GA13-06759S
LTT17003
KINEO II. CZ. 02.2. 69/0.0/0.0/18_053/0017163

EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research,
Development and Education

MINISTRY OF EDUCATION,
YOUTH AND SPORTS

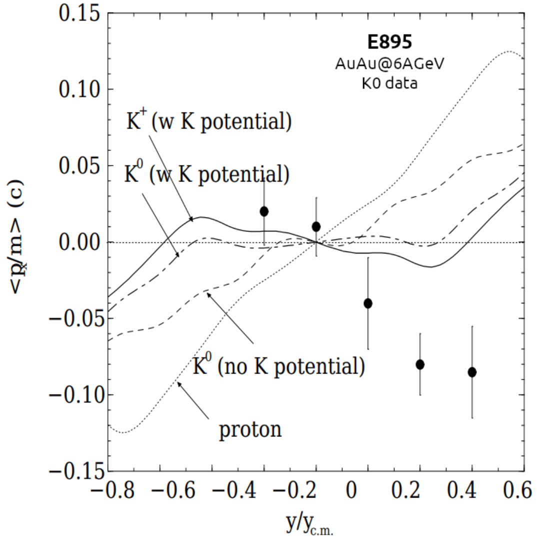
WHY IS IT INTERESTING TO STUDY KAON FLOW?

Kaons are good probe of EOS



PRL 86 (2001) 1974-1977

Kaon flow is very sensitive on KN potential



J.Phys. G26 (2000) 1665-1670

HADES	$\sqrt{s_{NN}}$	Data sample [events]
Au + Au	2.42	7×10^9
Ag + Ag	2.55	14×10^9

Production threshold NN→YKN:
$\sqrt{s_{NN}}$ = 2.56 GeV

AuAu – presented here
AgAg – analysis to be done

- Kaon propagation and production in medium is affected by KN potential
- Kaon flow is important test for microscopic models
- Scares data worldwide (KaoS, FOPI, START Fix Target) - no close threshold differential results

HADES AND FLOW MEASUREMENT

- Fixed segmented target (interaction prob. 2%)
- START & VETO detectors (trigger & time measurement)
- MDC & magnet (tracking & hadron id. via dE/dx)
- TOF & RPC (trigger & centrality determination & hadron id. via β(p))
- Forward Wall (event plane (EP) determination)
- DAQ (read-out with 10kHz for HIC and 50kHz for pp)

Fourier decomposition of azimuthal distribution w.r.t. reaction plane (RP)

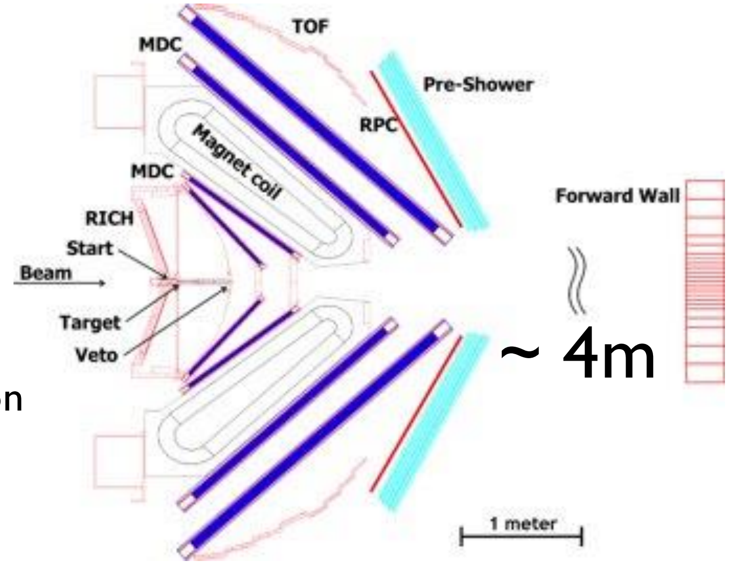
$$E\frac{d^3N}{dp^3} = \frac{1}{2\pi}\frac{d^2N}{p_T dp_T dy}\left(1+\sum_{n=1}^{\infty} 2v_n(p_T,y)\cos\left[n(\phi-\Psi_{RP})\right]\right)$$

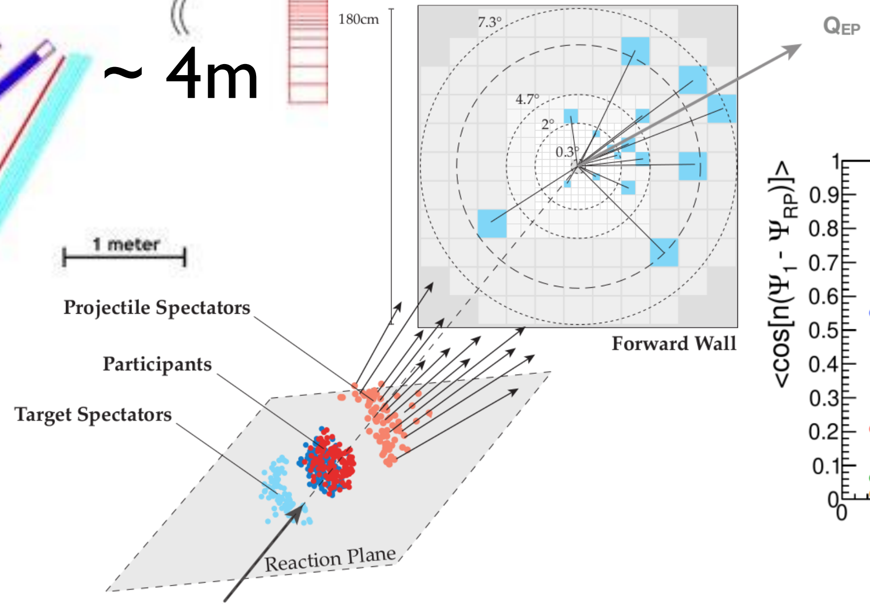
Replacement by EP

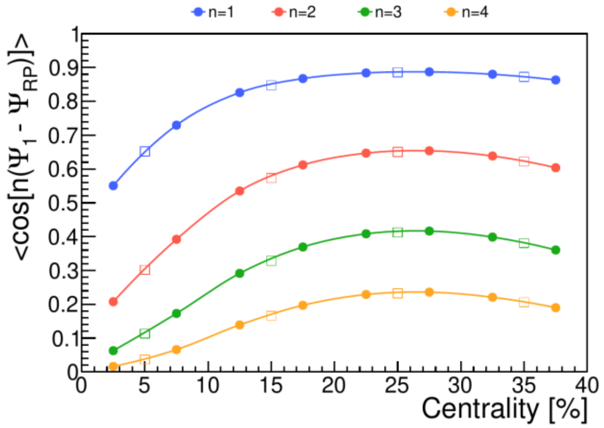
$$Q_n\cos(n\Psi_n) = \frac{1}{N_{FW}}\sum_{i=1}^{N_{FW}} |Z_i|\cos(n\phi_{FW,i})$$

Correction for EP resolution

$$v_n = \frac{v_n^{obs}}{\langle\cos[n(\Psi_1-\Psi_{RP})]\rangle}$$



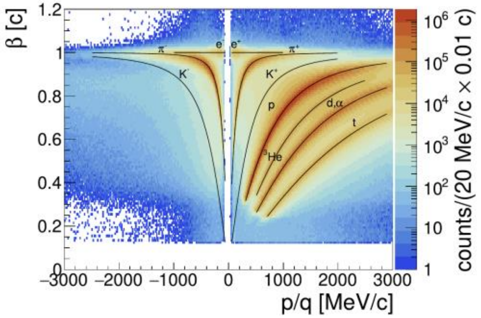




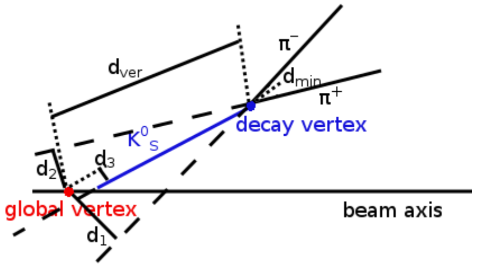
KAON IDENTIFICATION

K^0_s identification
- Decay to $\pi^+\pi^-$
- TMVA for TC optimization
- Mixed-event for residual bckg subtraction

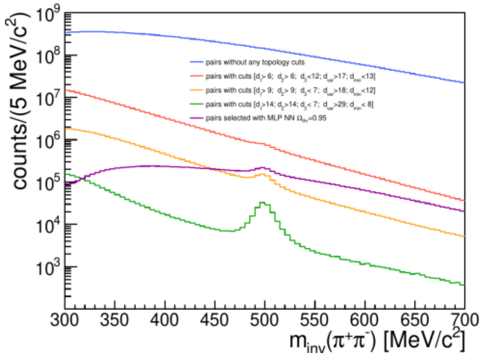
π± selection



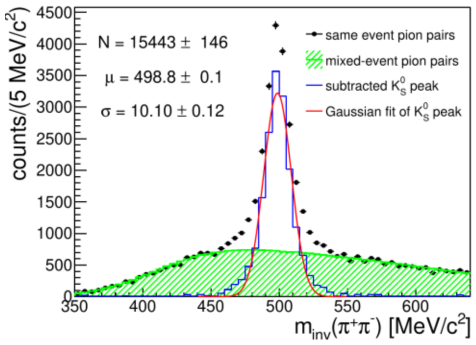
Topology cuts (TC) def.



TC selection power

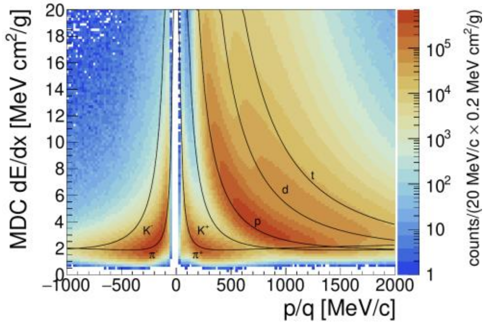


Resid. Bckg. Subtraction

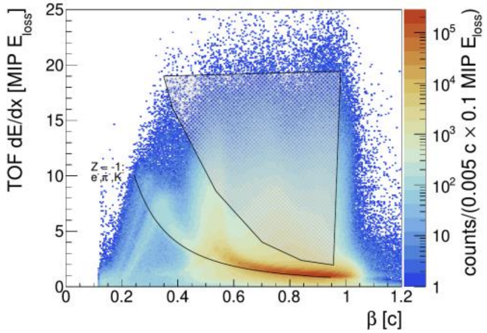


$K^\pm$ identification
- Track quality selection
- dE/dx in MDC & TOF
- Fit for bckg subtraction

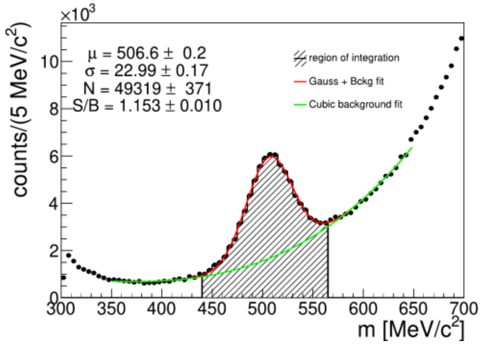
MDC dE/dx



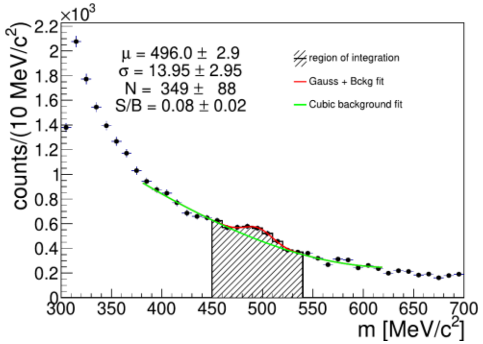
TOF dE/dx (veto)



K^+ mass spectra



K^- mass spectra



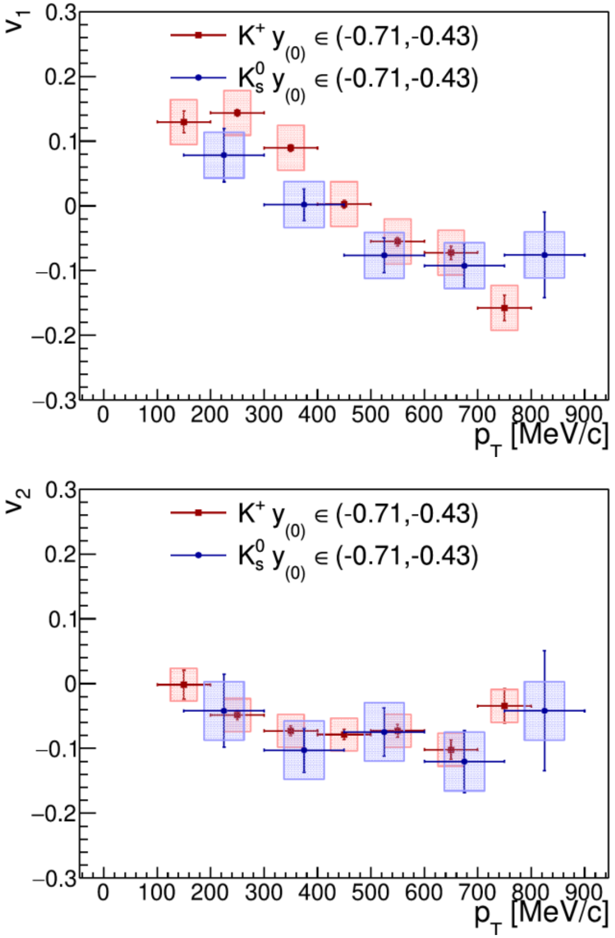
KAON FLOW RESULTS FROM AU+AU $\sqrt{s_{NN}}$ = 2.42 GEV

(PUBLICATION IN THE PREPARATION)

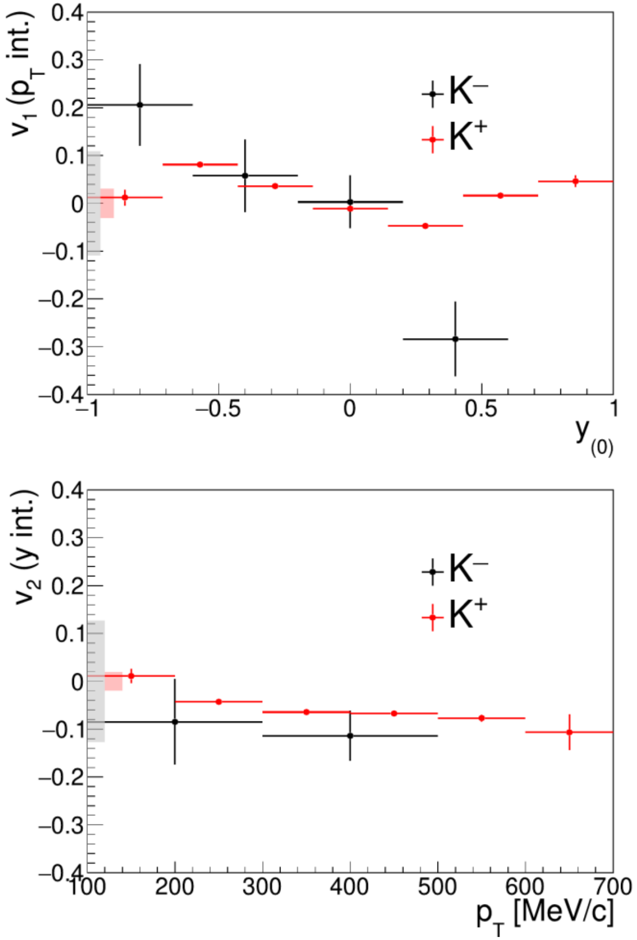
Main findings:

- K^+ and K^0_s behave identically (both contain s-bar)
- K^+ and K^- show similar trends (despite the opposite sign of (anti-)KN potential)
- Significant p_T dependence of v_1 and v_2 => necessity of differential approach for flow analysis (never done at sub-threshold energy)

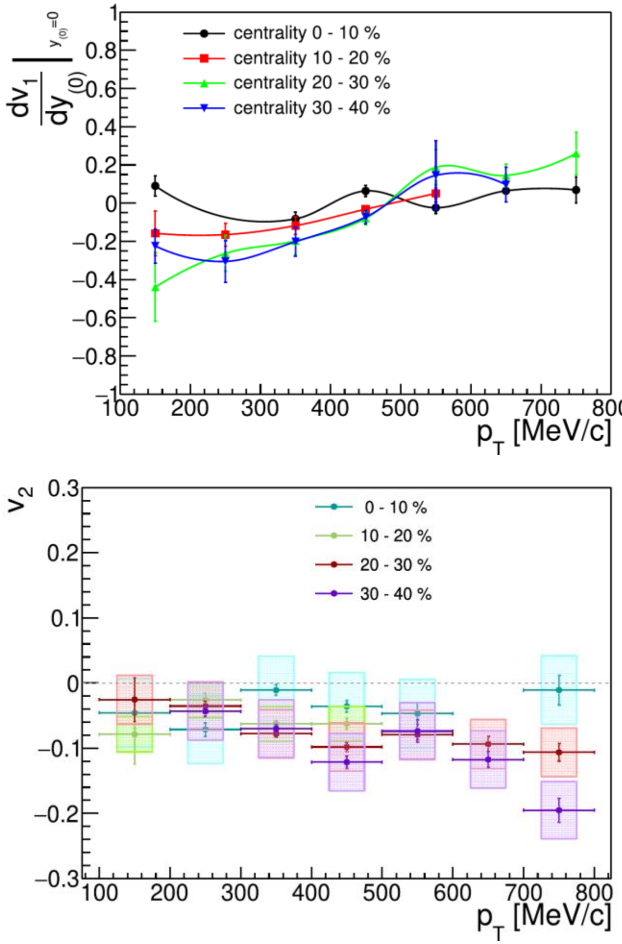
K^+ and K^0_s comparison



K^+ and K^- comparison



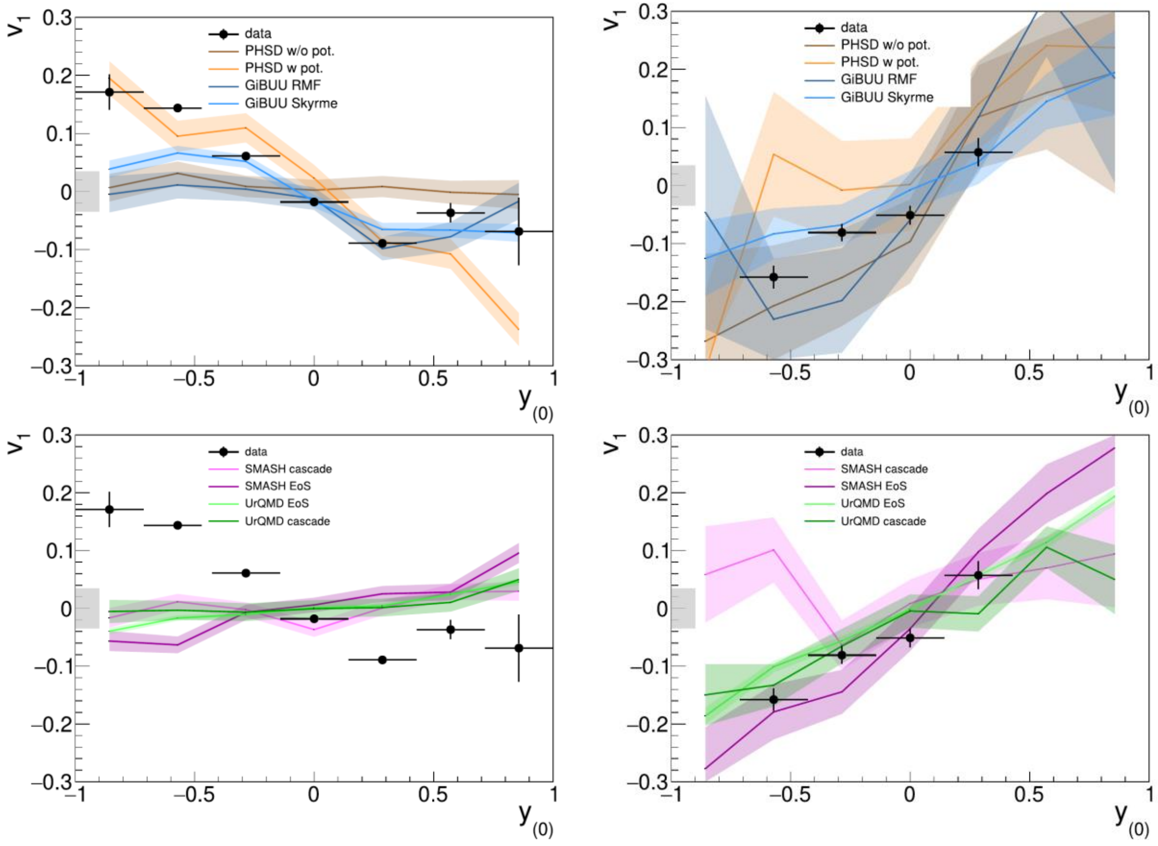
K^+ results



COMPARISON WITH MICROSCOPIC MODEL PREDICTIONS
(PUBLICATION IN THE PREPARATION)

Directed Flow

$200 < p_T < 300$ MeV/c $700 < p_T < 800$ MeV/c



Elliptic Flow

0-10 % centrality 20-30 % centrality